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Abstract

A NEW DISTILLATION TECHNIQUE FOR ISOTOPE CONCENTRATION

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It is well known that a liquid can be forced to rise on a vertical surface in the form of liquid thin film, if a gas with a sufficiently high velocity is used as raising agent.

Under these conditions mass transfer takes place in isothermal flow. In the CISE laboratories the application of concurrent two-phase annular flow as a contacting mechanism for the separation of the components of an isotopic mixture was studied since 1957. As a first application, the separation of oxygen-18 and deuterium by water distillation at room temperature, in the presence of an inert gas, was studied.

A 100-stage distillation plant was designed and assembled in order to test the feasibility and the best conditions in which a good contact between the two phases occurs. Air was chosen as the gas carrier. Mass transfer and hydrodynamic behaviour of the plant was studied in 2,000 hours of operation.

A further development of the contact technique was the application of this principle to conventional distillation column in a steam-water system; a suitable type of plate was designed for this purpose. Mass transfer and the hydrodynamic behaviour of a plate were studied in experiments carried out at temperatures ranging from 90° to 110° in a steam-water system.

In many respects this type of plate proved to be more advantageous as compared to conventional distillation plates, so that the investigation was pursued on a laboratory-scale column assembled with 24 plates. The efficiency, pressure drops and equilibrium time of the column were investigated. The column was designed for heavy water separation by fractional distillation, at temperatures ranging from 90° to 101°C. It is shown that concurrent

plates columns make possible a strong reduction in size, as compared to conventional bubble-plate columns; they appear to be easy to control and show a short equilibrium time and a low material hold-up.